

SERMC Safety SOP 43

From: SERMC Safety (C106)

Subj: SERMC Hot Work Procedures

Ref: (a) Navy Maritime Confined Space Program Manual, NAVSEA S6470-AA-SAF-010 (latest revision).  
(b) SERMC Safety SOP 27 Maritime Confined Space  
(c) SERMC Safety SOP 44 FACILITY FIRE PROTECTION and PREVENTION PROGRAM  
(d) Naval Ships Technical Manual, NAVSEA S9086-CH-STM-030/CH-074, Volume 1, Welding and Allied Processes.  
(e) Naval Ships Technical Manual, NAVSEA S9086-CH-STM-030/CH-074, Volume 3, Gas Free Engineering  
(f) Joint Fleet Maintenance Manual, COMFLTFORCOMINST 4790.3 (latest revision).  
(g) OSHA 29 CFR 1915.  
(h) NAVSEA OP 4, Ammunition and Explosives Safety Afloat, Hot Work Precautions

Encl: (1) SERMC Shipboard Hot Work Process Flowchart  
(2) SERMC Strip-back Distances and Separation Requirements for Heat Sensitive Material and Ammunition and Explosives  
(3) SERMC Shipboard Hot Work Request Notification Form  
(4) Appropriate Containment Materials/Construction  
(5) Appropriate methods for routing and securing Temporary services shipboard  
(6) Personal Protective Equipment (PPE) Requirements  
(7) Shipboard Oxygen System Hot Work Prohibitions

1. Purpose. To provide policies, processes and procedures to ensure Southeast Regional Maintenance Center (SERMC) hot work operations, as defined by this SOP, comply with the requirements of references (a) through (i) as applicable.

2. Cancellation. This revision replaces SERMC Safety SOP 43 dated 14 MAY 2019.

3. Applicability. This SOP applies to all hot work operations as defined by this SOP performed by SERMC personnel.

**NOTE:** SERMC personnel will not perform hot work on non-Navy owned or operated vessels.

4. Responsibilities.

a. SERMC Safety Department will:

(1) Monitor the effectiveness of this SOP and make revisions as necessary.

(2) Provide hot work certifications for shipboard hot work in accordance with references (a) and (b).

(3) Provide inspections and tests, as necessary, when welding, cutting, heating, or brazing will be performed on any structural voids such as stanchions, railings, and booms regardless of their location.

(3) Coordinate fire department approval and permitting for non-shipboard hot work in accordance with reference (c).

(4) Develop applicable training.

b. Supervisors of personnel who perform hot work will:

(1) Complete "SERMC Shipboard Hot Work Awareness Training," in Enterprise Safety Applications Management System (ESAMS) and ensure compliance with the contents of this SOP.

(2) Ensure that personnel complete "SERMC Shipboard Hot Work Awareness Training," training in ESAMS prior to assigning them to perform hot.

(3) Ensure that the ship is notified of all planned shipboard hot work and shipboard hot work areas are inspected and certified in accordance with the process identified in Enclosure (1).

(4) Ensure that all non-shipboard hot work (i.e. within the SERMC compound or on wharves) is approved by the Regional fire department in accordance with reference (c).

d. Employees performing hot work will:

- (1) Complete "SERMC Shipboard Hot Work Awareness Training," in ESAMS prior to performing hot work.
- (2) Conduct hot work operations in accordance with the requirements of this SOP.
- (3) Perform visual inspections of and a pressure drop test to include the torch, hoses, and gages whenever oxygen-fuel gas systems are connected to a supply manifold or bottle in accordance with Enclosure (5) of this SOP and references (d) and (g).
- (4) Ensure their Supervisor and SERMC Safety are immediately notified when any hazardous situation is detected, a fire occurs, an extinguisher is discharged, personnel injury, evacuation, or an emergency response is required.

## 5. Definitions.

Combustible material: Any material, other than flammable liquids and gasses, presenting a fire hazard during hot work operations, e.g., trash, paper, insulation rubber, wood, plastic, equipment including decking and furnishings that are constructed of these materials, etc.

Designated area: An area specifically established and designated for the performance of hot work that does not generally require daily inspection or certification.  
Shipboard Designated Areas are: The General Work Shop, Pipe and Damage Control shop, Hull Repair Shop, and Metalsmith shop.

**NOTE:** SERMC personnel performing hot work in shipboard Designated areas must obtain permission from the ship.

Drop Test: In accordance with reference (g), paragraph 1915.509, a drop test is a method utilizing gauges to ensure the integrity of an oxygen fuel gas burning system. The method requires that the burning torch is installed to one end of the oxygen and fuel gas lines and then the gauges are attached to the other end of the hoses. The manifold or cylinder supply valve is opened and the system is pressurized. The manifold or cylinder supply valve is then closed and the gauges are watched for at least sixty (60) seconds. Any drop in pressure indicates a leak.

**Fire hazard:** A condition or material that may start or contribute to the spread of fire.

**Fire watch:** The activity of observing and responding to the fire hazards associated with hot work in shipyard employment and the employees specifically trained and designated to do so.

**Flammable liquid:** In accordance with reference (a), any liquid having a flashpoint below 100 °F (37.8 °C), except any mixture having components with flashpoints of 100 °F (37.8 °C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.

**Hot Work:** For the purposes of ensuring uniform application of this SOP, hot work will be considered as any SERMC operations conducted shipboard that include flame heating, welding, grinding, torch cutting, brazing, carbon arc gouging, or any work which produces heat, by any means, of 400 °F (204 °C) or greater.

**NOTE:** If SERMC personnel will perform work that involves other potential ignition sources such as use of spark or arc producing tools or equipment, static discharges, friction, impact, open flames or embers, use of non-explosion proof lights, or operation of fixtures, motors, or equipment in the presence of flammable materials or flammable atmospheres that work will be considered as hot work.

**Hot Work Area:** The location of hot work operations and adjacent areas that may be affected through heat transfer or spark/slag migration.

**Hot Work Containment:** A system of temporary barriers that form a boundary around the hot workprocess to prevent sparks, slag, weld spatter, and heat transfer from coming into contact with or affecting combustible materials. The type of hot work containment necessary is a function of the type of hot work being accomplished and the specifics of the work site.

**Hot Work Operator:** Personnel performing hot work.

**Hot Work Supervisor:** Personnel responsible for assigning hot work operators to perform work.

Incipient stage fire: A fire, in the initial or beginning stage, which can be controlled or extinguished by portable fire extinguishers, without the need for use of ship's extinguishing systems, protective clothing, or breathing apparatus.

Physical isolation: As used in this SOP, physical isolation refers to the elimination of a fire hazard by removing the hazard from the work area (at least 35 feet for combustibles) or by positive isolation such as by covering or shielding the hazard with a fire-resistant material, or physically preventing the hazard from entering the work area.

6. Policies. SERMC's policy is that all hot work will be considered dangerous and that specific steps will be taken by SERMC personnel to reduce the risk of fire when performing hot work shipboard. Reference (c) specified the process for authorizing hot work with the SERMC facility or on wharves. Enclosure (1) of this SOP provides the process flowchart for shipboard hot work . Details regarding each step in that process are provided here.

a. Inspection of the work site. The hot work supervisor must inspect shipboard work sites and identify:

(1) Work side and backside strip-back requirements. Paint, various types of insulation, lagging, Passive Countermeasures Systems (PCMS) tile, etc. can be ignited or damaged by or through spark migration, slag, or heat transfer. These materials often have minimum strip-back requirements, invoked by technical instructions, which must be strictly adhered to. Enclosure (2) of this SOP provides minimum strip-back requirements.

**NOTE:** In accordance with Code 900 verbal policy, only ship's force will perform material strip-back.

(2) Adjacent spaces. Adjacent spaces and their contents can be affected by hot work through direct contact, spark migration, slag contact, heat transfer, etc. All adjacent spaces must be identified, evaluated, and treated sufficiently (i.e. cleaned or inerted) to prevent the spread of fire.

**NOTE:** Hot work in spaces adjacent to fuel tanks, loaded magazines, loaded Ready Service Lockers (RSLs), and

Flammable Liquid Storerooms require additional controls. Enclosure (2) addresses minimum requirements for loaded magazines, RSLs, launchers, etc.

**NOTE:** Openings in decks, bulkheads, overheads, ventilation ducts, air escape pipes, etc. within 35 feet of hot work will be secured or protected, as necessary. to prevent slag, weld spatter, or sparks, from passing into adjacent compartments, spaces, or decks.

(3) Adjacent equipment. Machinery, accoutrements, and piping in or adjacent to the hot work area will be treated like adjacent spaces and be protected from sparks, slag, dusts, heat, or flame with metal guards, curtains, or containments constructed of appropriate material.

**WARNING:** No hot work is to be performed on hollow metal containers and structures such as stanchions, railings, bitts, piping, drums, or structures unless they are opened, vented, and verified safe in accordance with references (a), (e) and (g).

(4) Combustibles. Prior to the start of hot work removable combustible materials (i.e. boxes, files, trash, paper, ship's stores, etc.) must be identified and removed at least 35 feet from the point of hot work,. Those materials that cannot be removed (i.e. desks, cabinets, carpeting, decks, bulkheads, partitions, etc.) must be treated in the same manner as Adjacent Equipment.

(5) Flammables. Hot work will not be performed in the presence of flammable or combustible liquids/gases. Stores of these materials must be removed.

(6) Interference. Items such as brackets, hangers, deck plating, cables, and piping. must be identified for removal or protection prior to the start of hot work.

(7) Fire watch requirements. At a minimum, a fire watch will be posted with a clear-line-of-sight of the immediate hot work area. Additionally, fire watches will be posted on the backside of heat effected hot work areas and anywhere sparks or slag can migrate outside of the view of posted fire watch.

b. Interaction with Ship's Force. SERMC personnel will not start hot work shipboard without documented acknowledgement by the ship's Commanding Officer or their designated representative.

(1) The ship will be notified of planned hot work using SERMC's "Hot Work Request/Notification Form," enclosure (3),, available on the Code 106 Safety Page of the SERMC Intranet under the Forms tab.

**NOTE:** This notification is independent of any required WAF and Tag Out requirements or SERMC Gas Free requests.

(2) Hot work operators will complete blocks 1 through 10 of enclosure (3) and deliver it to the ship's designated representative (duty fire marshal or DCA) for signature at least four hours prior to the start of work.

**NOTE:** A ship's force signed "Hot Work Request/Notification Form" will be effective for 24 hours unless a shorter period is specified by ship's force or work is interrupted due to loss of gas-free status.

(3) Request that ship's personnel perform strip-back and interference removal of items identified during the inspection of the worksite.

**NOTE:** In accordance with Code 900 verbal policies, only ship's force will perform material strip-back.

c. Request SERMC "Gas Free"/Maritime Confined Space Program personnel (MCSP) inspection and certification of all shipboard hot work sites.

(1) Prior to the start of any hot work operations, after the work area has been prepared, SERMC MCSP personnel will inspect and authorize SERMC shipboard hot work operations to ensure compliance with the requirements of references (a), (b), (g) and (h).

(2) Requests for inspection and certification will be made using SERMC's "SERMC GFE Inspection Form," available on the Code 106 Safety Page of the SERMC Intranet under the Forms tab.

(3) SERMC GFE MCSP personnel will post hot work areas/spaces with the appropriate certificate in accordance with reference (a).

d. Preparation of the worksite. Prior to the start of hot work, operators will perform the following:

(1) Verify that ship's force has removed interferences and performed strip-back of materials identified during the inspection of the worksite.

**NOTE:** Refer to enclosure (2) for minimum strip-back distances for heat sensitive materials.

(2) Verify that hot work will not conflict with contractor, ship, or SERMC work being performed in the area including painting, paint removal, solvent or chemical use, or tank opening.

(3) Install/build containments to protect adjacent spaces, equipment, and openings. Refer to enclosure (4) for appropriate containment materials and construction methods.

(4) Install services including welding lines and leads, gas and oxygen hoses, electrical cords, air hoses, and temporary ventilation. Services will be routed and secured in accordance with enclosure (5).

(5) Identify locations where fire watch personnel will be posted.

i. Fire watch personnel will be posted whenever hot work is performed. Each fire watch will have immediate access and an unobstructed view of the affected hot work area they are assigned to monitor.

ii. If multiple blind compartments are involved, separate fire watches will be posted simultaneously in each blind area.

iii. In cases where hot work, sparks, slag, or hot material involve more than one level, such as when working in trunks, machinery spaces, or on scaffolding a fire watch will be stationed at each level.



e. Retrieve the ship's force signed copy of SERMC's "Hot Work Request/Notification Form". SERMC Hot Work operators will:

(1) Verify that the notification form has been signed by the ship's Fire Marshal or DCA including, through their initialing of Blocks 11 and 12, acknowledging that ship's force personnel and extinguishers will be used for fire watch duties.

(2) Sign/initial block 14 of the original notification.

(3) Leave a copy of the signed notification form with the ship's fire marshal to allow for tracking and inspection hot work areas.

(4) Place the original, signed, copy in the Technical Work Document.

(5) Post a copy conspicuously at the location where hot work is performed.

(6) Ensure ship's force provided fire watch personnel fill out block 15 when they reach the work area and have been briefed on posting, communication methods, and expectations.

f. Performing hot work. Once hot work is started, the hot work operator and any personnel assisting them must continue to:

(1) Monitor the effectiveness of previously implemented controls (i.e. catches, containment, etc.) and strip-back distances.

(2) Keep combustibles (trash, dust, paper, etc.) out of the hot work area.

(3) Keep flammables (paints, solvents, chemicals, etc.) out of the hot work.

**NOTE:** Shipboard hot work processes requiring the use of flammable/combustible liquids such as alcohol cleaning of weld layers between weld increments must be coordinated with the ship and C106 by the production shop prior to the start of work.

(4) Communicate expectations with fire watch personnel ensuring:

i. They are able to verify continued adequacy of controls.

ii. They remain posted for at least 30 minutes after hot work is secured or until material becomes cool to the touch, whichever is longer.

i. They remain alert.

ii. They are properly equipped (have the proper extinguisher and PPE),

iii. Understanding of effective methods of communicating with the hot work operator especially when fire watches will be positioned where direct communication is not possible, and

iv. They know to stop a hot work operator if there appears to be a dangerous condition or sparks/slag escapes containments or boundaries.

**NOTE:** Personnel assigned to fire watch will only act as a fire watch. No other task or function will be assigned to fire watches during the hot work process and cool down period.

(5) Use required PPE and ventilation to protect themselves and other personnel in the work area. Enclosure (6) identifies some process specific hazards and PPE requirements.

g. Securing the worksite. When hot work will be secured for breaks or lunches, finished for the shift, or completely finished, the hot work operator is responsible for verifying the following conditions:

(1) Regardless of the duration of the break, fire watch personnel must remain on station for a minimum of 30 minutes after hot work is secured or until the hot work area is cool to the touch, whichever is longer.

(2) The work site is placed in a safe condition including:

(i) Securing tools and equipment.

(ii) Welding machines and other electrical equipment are de-energized at their source.

(iii) Fuel/gas lines are depressurized, secured at the source, and rolled back onto the weather decks or removed completely from the ship.

(iv) The work area is clean and free of any debris or trade litter.

(3) The ship is notified that work is complete or will continue on the next shift, or next day, as appropriate.

**NOTE:** A completed "Hot Work Request/Notification Form," enclosure (3), is required for each day's hot work.

(4) SERMC GFE/MCSP personnel are notified if recertification is required on successive shifts or days.

h. Emergency procedures. If a fire occurs, the hot work operator and fire watch personnel will take the following actions:

(1) Stop work immediately.

(2) Try to extinguish or control the fire (if personnel safety is not in jeopardy).

(3) Warn other personnel in the area.

(4) Report, or have someone else report, an alarm to the quarterdeck immediately.

(5) SERMC personnel will evacuate the ship and muster in designated mustering areas to be accounted for in accordance with SERMC's "Shipboard Fire Safety and Emergency Response Plan," SOP 34.

(6) Report the fire to their supervisor and SERMC Safety.

**NOTE:** When a fire extinguisher is discharged, for any reason, it must be reported to the Ship's Duty Officer/Fire

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Marshal. Hot work will not be resumed until it is reauthorized by SERMC Safety, the hot work supervisor, and ship's force Fire Marshal.

i. Unique situations. Hot work processes that must rely on use of inerting agents (agents outside the normal use of shield gasses) or pressing up (using water to displace atmospheres) must be approved by SERMC's GFE or an NFPA Certified Marine Chemist.

**NOTE:** Enclosure (7) provides prohibitions' regarding hot work adjacent to ship's oxygen systems.

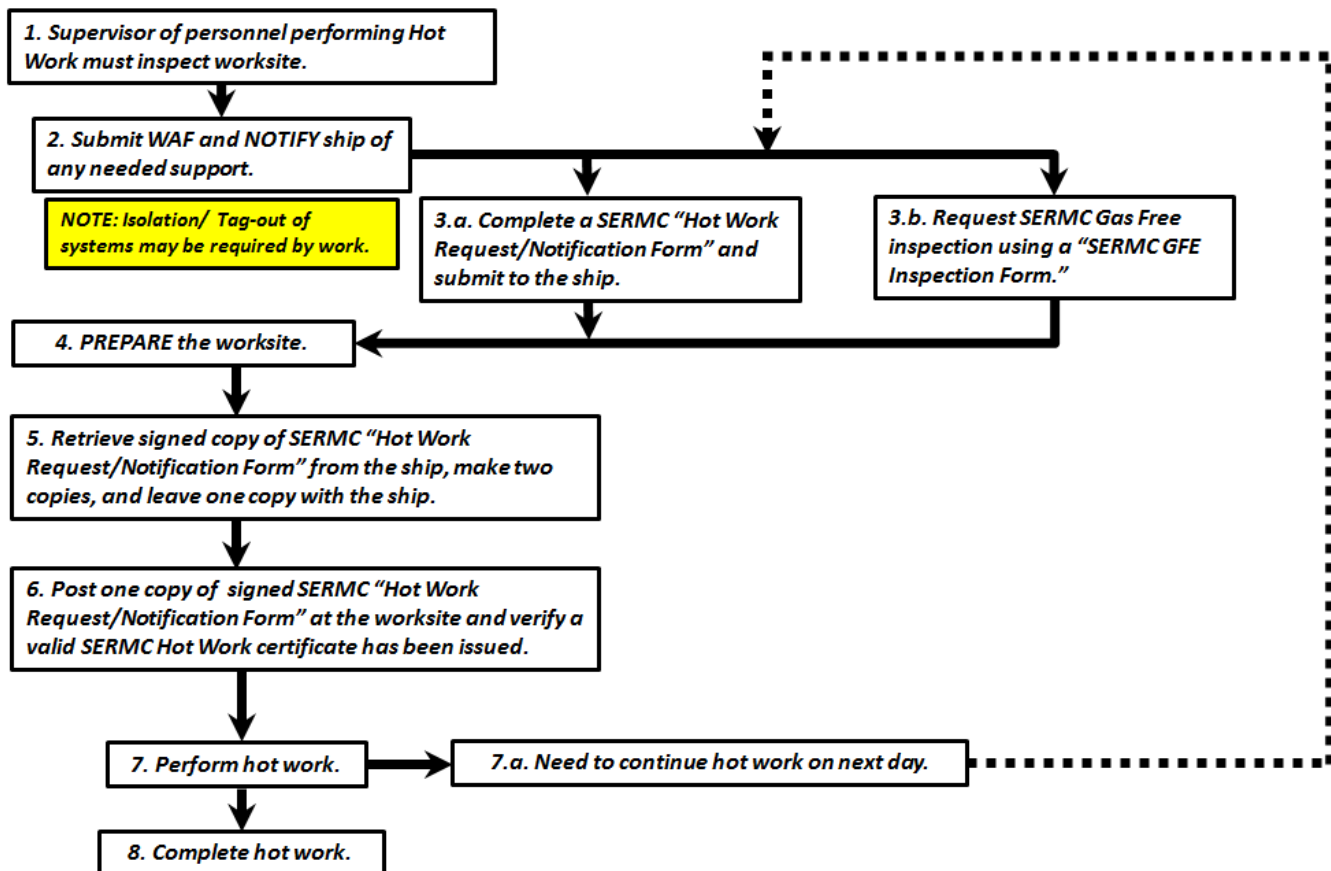
/s/

Aaron E. Moore, C106

## SERMC Shipboard Hot Work Process Flowchart

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This flowchart identifies the general steps to be taken by SERMC personnel preparing to and performing, shipboard hot work. Refer to paragraph 6, Policies, of the SOP for detailed information regarding each step.



# SERMC Strip-back Distances and Separation Requirements for Heat Sensitive Material and Ammunition and Explosives

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1. Minimum strip-back distances for heat sensitive materials are provided in the following table.

<b>Strip-back Distances For Heat Sensitive Material</b>		
MATERIAL TYPE	STRIPBACK DISTANCES (NOTES)	
	HOTWORK SIDE	OPPOSITE SIDE
HULL INSULATION (PVC)		
Thermal Cutting (torch, arcing, plasma)	36"	36"
SMAW, Brazing, Strip Heaters	24"	24"
GTAW, GMAW, Grinding, Auto Timed Stud Welding	12"	12"
FIBERGLASS INSULATION	6"	6"
PCMS material	12"	12"
BARIUM SULFATE LOADED VINYL (BSLV) SHEETS	12"	12"
ACOUSTIC INSULATION WITH BSLV SEPTUM MATERIAL	12"	12"
SOUND DAMPENING (Not PVC or SHT)	6"	6"
TOXIC COATINGS (Paint containing lead, zinc cadmium, chromium, copper, etc.)	4"	4"
EPOXY PAINT, ENAMELS, ETC.	4"	4"
ULTRA HIGH SOLID PAINT		
Thermal Cutting (torch, arcing, plasma)	8"	8"
All other hot work	4"	4"
SPECIAL HULL TREATMENT (SHT)	12"	12"
TILE, DECKING, MASTICS, GRAPHITE, ETC.	12"	12"
SPRAY IN FOAM INSULATION	24"	12"
<b>NOTES:</b> <ul style="list-style-type: none"> <li>Material around the hot work (including exposed edges) must be protected with a wetted Refrasil® cloth, or equivalent, to prevent slag/spark contact.</li> <li>If contaminated with fuel, oil, or solvents strip-back 12".</li> <li>Thermal cutting through plate or structures requires HOTWORK SIDE strip-back distances to be maintained on both sides of the plate/structure being cut through.</li> </ul>		

**NOTE:** Additional strip-back may be required based on actual worksite conditions (i.e. contaminated/oil soaked materials, potential for spark/slag migration, etc.). Exposed edges of materials must be protected from heat, sparks, slag, etc.

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a. Strip-back exceptions. In accordance with reference (a), a SERMC GFE can waive requirements pertaining to hot work for the opposite side (e.g., certification, fire watch and insulation removal) based on objective evidence that temperatures will not reach or exceed 400°F on an adjacent space and/or opposite side, as applicable.

i. Objective evidence includes mock-up testing by a welding engineer, direct temperature readings, etc.

ii. Any waivers, as well as requirements being waived will be documented in writing by the GFE.

b. Strip-back requirements, based on technical requirements, such as those for PCMS or Sound Dampening materials cannot be waived by the GFE without approval of the Technical Warrant holder for those materials.

2. Hot work adjacent to ammunition and explosives will be performed in accordance with the requirements of reference (h).

## SERMC Hot Work Request Notification Form

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This notification form is available in editable electronic format on the SERMC Safety Department SharePoint under the Forms tab.

<b>HOT WORK</b>			
<b>SERMC Hot Work Request/Notification Form</b>			
1. From:		2. To:	
3. Date of Request:			
4. Vessel:	5. Job Order:	6. Date and Time of Work to be Performed:	
7. Description of Work:			
8. Specific Location:			
9. Adjacent Spaces:			
10. SERMC Hot Work Supervisor (print name):		Initials:	Phone Number:
11. S/F Fire Watch to be Utilized:		12. S/F Fire Extinguisher(s) to be Utilized:	
<input type="checkbox"/> Yes <input type="checkbox"/> No   If Yes, DCA Initials <input type="text"/>		<input type="checkbox"/> Yes <input type="checkbox"/> No   If Yes, DCA Initials <input type="text"/>	
<b>AREA INSPECTED AND DETERMINED SAFE FOR HOT WORK</b> Operator certifies that he/she has inspected all areas as required by the applicable hot work instructions. This inspection shall include checking all sides affected by the hot work operation with the assigned fire watch (if required) and removing or protecting combustible materials. The hot work operator shall post fire watches as required and ensure that hot work can be performed safely. "Safe for Hot Work" Gas Free Certificate is posted (if required).			
14. Hot Work Operator (print name):		Initials:	Date:
15. Fire Watch (print name)		Initials	Date
16. Duty Fire Marshal (print name):		Initials:	Date:



When combustible materials, equipment, and openings must be protected from sparks, slag, weld spatter, flame, grinding dust, etc., a protective containment must be constructed prior to performing hot work.

The containment system used must suit the type of hot work to be accomplished and the specifics of the work site.

Containment systems can include one or more of the following:

1. Burn boxes (i.e. containments sealed to the hull or bulkhead) constructed of 3/16" thick (minimum) steel used to catch and to prevent molten metal from escaping.
2. Fire cloths can be used as catches or drapes.
  - a. Vertically hung as a curtain around a hot work site to prevent spark and slag migration.
  - b. Horizontally hung under to act as a catch for sparks and slag.
  - c. Approved fire cloth material includes:
    - i. Refrasil™ silica (silicon dioxide) cloth with any needed joints having a 6" minimum overlap that is secured by folding and clamped or taped with Refrasil™ cloth tape.
    - ii. Aluminum silicate, Wetpack™ Ceramic Fiber Insulation, blankets.
    - iii. OmniSil™ silicon dioxide cloth, similar product is PyroSil SNM™ by Poly Shield Inc.

**NOTE:** These materials cannot be used as the sole method of protecting against or catching slag or molten metal.

**NOTE:** Refrasil® cloth and tape may be used to further seal seams of Burn boxes.

3. Ship's structure (i.e. solid decks and bulkheads) may be considered as part of a suitable containment system as long as they are:

a. Sufficiently protected (such as through the use of sheet metal or fire cloth) from damage.

b. Suitably clean (i.e. free of combustible or flammable contaminants).

4. Acceptable containment fastening methods. Hot work containments must not be fastened, suspended, or sealed using combustible materials (such as duct tape or string). Approved fastening methods include:

a. Metal alligator or "C" clamps.

b. Refrasil<sup>™</sup> cloth tape.

c. Magnets.

d. Refrasil<sup>®</sup> or fire cloth tape

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All services including welding lines and leads, gas and oxygen hoses, electrical cords, air hoses, and temporary ventilation must be installed, routed, and maintained in such a manner to minimize the effect they have on the ability to combat casualties, including fires.

When installing services SERMC person will adhere to the following requirements unless otherwise noted.

1. Service line(s) will not be run through fire zone boundaries unless quick disconnects are installed in those lines within 6 feet of the opening, door, or closure.

a. A "quick disconnect" is a coupling or connecting device/system designed to permit easy and immediate separation of lines without the use of tools and to ensure the contents do not escape or personnel are harmed by energy contained within.

b. Quick disconnects will be marked with international orange tape and be positively identified with durable unique markings that identify SERMC as the owner of the service, the service type, location, and applicable shut-off points.

c. The number and types of services run through fire zone boundaries will be minimized so that all of them can be secured and pulled back within 3 minutes.

**WARNING: Fuel gas/oxygen/compressed gas hoses, hoses pressurized above 140 PSI, or hoses carrying hazardous/toxic/flammable materials will not be run through fire zone boundaries.**

d. Hose numbers or sizes will not restrict free and easy access or closure of fire zone boundary doors.

2. SERMC oxygen, acetylene, other fuel gas, or shield gas and supply systems may be placed on board ships as long as they are located on a weather deck and equipped with a shutoff valves.

a. Oxygen, acetylene, and fuel gas supply systems will be stored to prevent collisions by trucks, forklifts, falling objects, etc.

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b. When gas cylinders are in use on board ship, they will be located on the weather decks or in a location determined jointly by the SERMC C925, SERMC Safety, and Ship's Force, and will be secured in an upright position.

c. The number of in-use cylinders will be limited to those which are required for work in progress and which have pressure regulators connected to the cylinder valves.

**NOTE:** The use of ship's force gas supply systems is only authorized if approved by the Damage Control Officer (DCA). Only Ship's Force personnel will move, locate, and secure their bottles. SERMC personnel utilizing these bottles are responsible for performing visual inspections and necessary drop tests to ensure the integrity of system.

**NOTE:** SERMC will not maintain reserve gas cylinders onboard the ship.

d. When not in use, gas cylinders and manifolds on board will have valves closed, lines disconnected, protective cover (cap) in place, and will be secured. Acetylene cylinders will be secured in an upright position.

e. Each SERMC fuel gas and oxygen hose run will be positively identified with durable unique markings that include SERMC POC information, service type, location, and shut-off points. Identification will be located (at a minimum) at the source, point of entry into the ship, at each connection point (including quick disconnects), and termination point.

f. Unattended fuel gas and oxygen hose lines or torches are prohibited in confined or enclosed spaces.

g. All fuel gas and oxygen hose lines will be disconnected at the supply manifold at the end of each shift.

h. All disconnected fuel gas and oxygen hose lines will be rolled back to the supply manifold or to open air.

3. Whenever oxygen-fuel gas systems are connected to a supply manifold or bottle, a pressure drop test to include the torch, hoses, and gages will be accomplished.

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a. Apply pressure to the system. Back off pressure by turning off the valve supplying gases to the system. If the pressure on the gage drops, a leak in the system exists. If the pressure on the gage does not drop, the system is tight.

b. After applying pressure, wait 2 minutes to ensure pressure does not drop.

c. The use of gas hose splitters is prohibited.

4. Each inert gas/oxygen depleting (OD) hose run will be positively identified with durable unique markings that include the responsible code, service type, location, and shore side shut-off points. Tags will be located (at a minimum) at the source, point of entry aboard ship, at each connection point (including quick disconnects), and termination point.

a. Unattended inert gas/OD hose lines or torches are prohibited in confined or enclosed spaces.

b. All inert gas/OD hose lines will be disconnected at the supply manifold at the end of each shift.

c. All disconnected inert gas/OD hose lines will be rolled back to the supply manifold or to open air to disconnect the torch.

5. Whenever inert gas/OD gas systems are hooked up to a supply manifold or bottle, a pressure drop test to include the torch, hoses, and gages will be accomplished.

a. Apply pressure to the system. Back off pressure by turning off the valve supplying gases to the system. If the pressure on the gage drops, a leak in the system exists. If the pressure on the gage does not drop, the system is tight.

b. After applying pressure, wait 2 minutes to ensure pressure does not drop.

c. The use of gas hose splitters is prohibited.

6. Storage of material aboard ship will be limited to that which is required for work in progress.

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7. SERMC's use of ship's services (including electrical power or air) must be authorized by the ship's CHENG.
8. Temporary lighting fixtures will not be used to power portable electric tools.
9. SERMC temporary cables and hoses will be maintained in a safe condition.
10. Temporary services will be suspended using non-combustible high temperature devices, brackets, or material. Plastic tie wraps, string, rope, or other combustible material will not be used.

- a. All temporary services will be positively identified with durable unique markings that include the responsible code, service type, location, and shore side shut-off points. Tags will be located (at a minimum) at the source, point of entry aboard ship, at each connection point (including quick disconnects), and termination point.

- b. Temporary service lines will be routed to allow emergency access and egress to all areas of the ship and will not impede damage control and watch-stander performance of duties. Where appropriate, run temporary services outboard to keep passageways clear.

- c. Temporary services will be removed from the ship immediately when no longer needed.

11. Temporary ventilation systems used for exhausting hot work processes will be arranged so that ducting is under negative pressure. Only fire retardant ventilation ducting will be used.

**NOTE:** The use of ship's permanent or temporary vent systems in support of SERMC hot work operations is prohibited.

12. SERMC may use portable bottles, light-duty oxy-fuel system portable kits (i.e. TurboTorch®) shipboard when the following precautions are met.

- a. Permission must be granted by the ship's DCA in writing.
  - b. The system to be used cannot have a gas capacity exceeding 10 ft<sup>3</sup>.

Appropriate methods for routing Temporary services  
shipboard

SERMC Safety SOP 43

c. These systems cannot be used in confined or poorly ventilated enclosed spaces as defined by reference (a).

d. Each use must be authorized by a SERMC GFE. The GFE will:

i. Evaluate the volumes of the space where the systems are to be staged to support work and system gas capacity.

ii. Assign controls (such as temporary ventilation and/or continuous monitoring) necessary to allow for the use of these systems.

**NOTE:** Use of these systems is prohibited in spaces where volumes could allow an oxygen enriched atmosphere (> 22%) or an atmosphere containing greater than 10% of the lower explosive level (LEL) to occur in the event of system failure.

e. "Drop Testing" of these systems will be performed both prior to taking them aboard ship and once staged on the ship.

f. These systems will not be taken aboard the ship until they are needed to perform the required operation.

g. These systems will be removed immediately after work has been inspected SAT or work is secured.

## Personal Protective Equipment (PPE) Requirements

SERMC Safety SOP 43

Aside from the risk of fire or explosion, hot work exposes personnel to many hazards. Some hazards include toxic metal exposure, toxic gas exposure, particulate exposure, eye hazard exposure, and burn exposure.

1. Toxic Metals. Any hot work (Shielded metal arc welding (SMAW), gas metal arc welding (GMAW), flux cored arc welding (FCAW), carbon arc cutting (CAC), and plasma arc cutting (PAC), brazing, or torch heating) involving base, filler, and coatings that contain metals such as lead (Pb), cadmium (Cd), hexavalent chromium (Cr(VI)), and beryllium (Be) very easily have the potential to expose personnel above OSHA substance specific standards. Such processes include, but are not limited to:

a. Hot work in the presence of coatings containing Pb, Cd, or CrVI.

b. Brazing with Grade IV or V filler materials that contain Cd.

c. Hot work on base metals, or with filler materials, containing chromium such as stainless steels (CRES), Inconel and CrMo alloys.

**NOTE:** Gas tungsten arc welding (GTAW or TIG), due to light fume generation of Cr(VI), does not generally pose an exposure hazard.

d. SMAW, GMAW, FCAW, CAC, and PAC on or near ballast bins with lead, or lead residue, present.

e. Personnel performing hot work processes involving these metals must be provided with additional training and use controls (i.e. respiratory protective, coveralls, temporary ventilation) to prevent significant personnel exposures.

**WARNING:** CODE 106 MUST BE NOTIFIED PRIOR TO HOT WORK INVOLVING THESE METALS.

2. Gasses. The high temperatures, ultraviolet light, combustion processes, and shield gasses associated with hot work create physical and toxic gas exposure hazards. Some examples include:



## Personal Protective Equipment (PPE) Requirements

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a. High temperature associated with oxy-fuel heating and cutting generate oxides of nitrogen. Nitrogen dioxide is very irritating and corrosive to the eyes and respiratory tract.

b. Ultraviolet light from plasma cutting and MIG welding generate ozone. Ozone is very irritating and corrosive to the eyes and respiratory tract.

c. Combustion processes involving hydrocarbons generate carbon dioxide and, in the case of incomplete combustion of the fuel gas, carbon arc rods, or burning of paint, carbon monoxide. Carbon dioxide is a simple asphyxiant, displacing oxygen in the atmosphere, and carbon monoxide is a very powerful chemical asphyxiant, displacing oxygen in the blood.

d. Shield gasses such as argon, helium, carbon dioxide, and nitrogen, if not properly ventilated can very rapidly become simple asphyxiant, displacing oxygen in the atmosphere, in small spaces.

3. Ultraviolet (UV) Radiation hazards. The UV generated by arcs is damaging to the eyes and skin. Clothing, gloves, and shields must provide UV protection.

4. Respiratory Protection. As noted above, hot work processes expose personnel to hazards including dust, fumes, and gases. Appropriate respiratory protection shall be worn by personnel engaged in, observing, or participating in hot work processes.

5. Eye Hazards. To protect personnel from ultraviolet light exposure process specific appropriate shades of eye protection must be worn. Recommended ANSI shades are indicated in the following table.

<b>Eye Protection for hot work processes- SHADE DENSITY GUIDE</b>	
<b>OPERATION</b>	<b>ANSI Shade No.</b>
Air-Arc Gouging	11 to 14
Plasma-Arc Welding & Cutting	10 to 14
FCAW (Flux Core Arc Welding)	11 to 12
GMAW (Gas Metal Arc Welding)	10 to 12
GTAW (Gas Tungsten Arc Welding)	10 to 12
SMAW (Shielded Metal Arc Welding)	10 to 12
Oxy-Fuel Cutting	
Light - up to 1"	3 or 4
Medium - 1" to 6"	4 or 5
Heavy - over 6"	5 or 6
Torch Brazing	3 or 4
Thermal Spraying	3 or 4
Soldering	2
Fire Watches Fire watches must be protected from flash but must be able to see sparks or slag escaping from the hot work process. Fire watch personnel must be instructed to never directly observe welding or arcing source directly.	3

**NOTE:** All eyewear worn during hot work must meet impact resistance requirements in accordance with ANSI Z-87.1. Safety glasses must be worn under welding shields.

To protect personnel from particulate, fumes, and gas exposure process specific ventilation and/or respiratory protection may be required. SERMC SOP 15 identifies respiratory protection requirements.

3. Burn hazards. To protect personnel from burn injuries associated with the high temperatures of hot work PPE must be worn and maintained properly. Hot work operators will:

- a. Utilize a full-face welding helmet.
- b. Wear welding gloves.
- c. All clothing (i.e. pants, shirts, and coveralls) will be in good condition. Clothing with cuffs, holes, strings hanging, cut fringes, or fraying edges will not be worn.

## Personal Protective Equipment (PPE) Requirements

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d. Wear welding leathers or long sleeve shirts. The shirt must not have holes, cuts, or fraying edges.

e. Wear clothing made of tightly woven wool, cotton or cotton denim.

**Note:** Clothing made of synthetic materials such as nylon, Dacron®, polyester, etc. will not be worn as sparks or fire coming in contact with them will melt and stick to the skin.

f. No clothing impregnated or covered in full or part with flammable or combustible materials (such as grease or oil) may be worn by hot work operators or fire watch personnel.

## Fire Watch Duties and Responsibilities

SERMC Safety SOP 43

# Fire Watch Duties and Responsibilities

SERMC Safety SOP 43

When ships have active oxygen systems hot work is prohibited in the following locations:

	<b>When oxygen is being loaded</b> (from another ship or pier)	<b>When oxygen is being offloaded</b>	<b>When an oxygen system has not been offloaded or inerted</b>	<b>When oxygen is being generated</b> (in EOG/O2N2 Plant)
<b>SURFACE SHIP: Hot work prohibited</b>	Throughout ship	Within 50' of discharge connection and vent	Within 50' of any part of that O2 system	Within 50' of EOG/O2N2 Plant
<b>SUBMARINE: Hot work prohibited</b>	Throughout submarine	1) Within pressure hull  2) Within 50' of an O2 charging connection or vent to atmosphere	1) In a compartment that contains a header that has not been inerted.  2) In the same compartment within 10' of an O2 bank cutout/ backup valve  3) In or on the ballast tank that contains that system's O2 flasks or piping.  4) In a ballast tank that borders the one that contains O2 flasks or piping	Within 50' of EOG/O2N2 Plant